Organic life in water

A study of algae and aquatic creatures

By Ron Drozdik, Espen Bærheim and Fredrik Olsen

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About the project

When it comes down to water there is a lot to talk about. There's a lot to discover and to analyse. Water exists in every part of our life, whether it's the water in our body, the water we drink or the water we consume while eating. When having a project about water, one quickly understands that the possibility of choices is endless. One can talk about the physics of water, or water in the body, or water in your house, water in the industry, the chemistry of water, water lakes or rivers, water as rain, acid rain, water in space, water in plants, what water does in our body, and tons of more. You quickly realise that it is important not to have a wide project that covers too much. Having a project about water industry is in our view a very big project, because industry is so many things. And to talk about every industry would be too much. Talking about water in industry in general would be too plain, and there would lack depth to the project. It is better to have a specific project rather than having one too big.

We faced with such a problem at the start of our project. We all agreed at doing something that we found interesting. There would be no meaning in spending time with a project if we found it dull. The first things that dropped in our mind were the chemistry of water. It looked great at the beginning, but the more we thought the more we realised that this project was way too big. Since water is such a big part of life our project would've been just as big. Instead we came up with the idea of water in our body, liquid water, and water as gas. But again, we found out that the project was big, and *water in the body* didn't quite fit with the two others. Having a project about just liquid water seemed like a better idea. How does liquid water affect people, industry, and nature? Where does it come from? Where is it found, and the chemistry of it. In a project it is important to have a good idea at first, without such an idea, the project won't turn out that great. Liquid water is still a big project, but we weren't quite happy with it, we didn't find the idea that good. There was also nothing special about it. The last idea we came up with was algae, or organic life in water. The project wasn't anymore about how water affects things, but how organic life in water affects water. This project was small enough for us, because we only had to learn about algae and other small organisms in water. But more importantly, we all were very excited about the idea. The main task in this project was to learn about organic life in water and algae, not by reading it in some book, or the net, but by actually going out and investigating it ourselves. We had all the right equipment and we could do lots of other experiments, which we found exciting. That was why we chose this project, and that's what this project is about.

We selected four lakes, three rivers, and the beach; all of these were close to where we lived. Our task was to analyse this settings; find out what algae they had, what and how many organisms lived in them, measure the Ph levels, and at last try to find out the salt levels. Then we were going to figure out why they had algae in them, why the Ph had such levels, and why they had different organisms in them. Does the agriculture around the lake affect it? If so, then how? How do algae affect water, and what does it do in water? What does small organisms do in water, what do they eat? We tried to answer all these questions and more. Our main task in this project wasn't just to have fun, but also to learn about algae, and organisms in water and how all of these affect each other and the territory around.

A great deal of our project is based on experiments rather than just reading about something and writing it down. Other experiments we did were to breed algae in different liquids to see where they thrived the most. It's all a part of having fun with the project, while still being able to gather valuable results. Measuring the salt was a simple idea, which originated from the fact that we had the ability to electrolyse water. We wanted to electrolyse water, but just had to find a way on how to use it in our project. And so we though we could measure salt. One of us also had electric measurements tools, which also proved useful in our investigation. Nevertheless, we were not able to measure the content of salt in the water, we could only compare. *We don't know how much salt Orrestrand has, but accordingly to our numbers it has much more than Møllevannet*. In such a way we compared the salt levels in all of our places.

We all believe our project was a success, we did all of our work as planned, and within a schedule we had made. We got a good result in every of our experiments, which proved that they too were successful, although, some of the results might've been slightly inaccurate due to low quality equipment. Nevertheless, we were happy with the way our project turned out and felt we had accomplished what we had intended. We all have learned something from this project, and we learned it without sitting down reading a book, but by doing things and discovering them by ourselves, which in my view is the best way of learning something. This project doesn't of course cover everything about algae and organisms in water. But covers the area around where we live. We have written some information about algae and water organisms, but those are not based on any of or reports. We thought we should include such information since it's a part of what we're doing.

* We took all the pictures in this project. Microscopic pictures of organisms or algae we could not take because we lacked the proper equipment.

I.
II.
Our hypothesis

The main thing we want to find out about is the effects algae have in water and the consequences of them. We think that it maybe is too late in the season for algae to be alive, and we are a little bit concerned about that.

We started out our different experiments with the following thoughts.

Algae with ammonium chloride: This is never going to work out. We think that the ammonium chloride is going to kill the algae instantly.

Algae with bottle water: This was going to work out just fine. Normal, clean water shouldn't be a problem for the algae.

Algae with sparkling water: We are a little unsure about how this will go. We don't know if algae can handle that much carbon dioxide.

Algae with acetic acid: We believe this one will face a quick death. It's very improbable that algae can live in such sour conditions.

Algae with sprite soda: This one we think will die pretty soon. We don't think algae will survive in such conditions for very long.

While with the experiment where we are going to measure the electrical resistance in different locations we don't really have a clue what to expect. Although we think that the more salty the water, the better it carry electricity.

We do of course expect to find organic life in every of the different waters we are going to report. We are not sure of what kind of organisms we'll find, but from previous experiments we know that Frøylandsvannet does have worms, backswimmers and mid. We also expect to find more algae in Frøylandsvannet than any other waters because Frøylandsvannet has experience algae blooming many times in the past. From the other waters we don't expect to find large amount of algae, since none of these waters have had serious algae problems. We also don't expect to find many organisms or algae in Orrestrand, because of the high levels of salt in the water.

In the electrolysis part we hope to experience some cool colours coming out from the water. This happens in water that contains a lot of salt. But what we hope isn't what we expect. We know that there is going to happen something from Orrestranden, since it's water from the ocean, which has lots of salt. But we don't expect a lot from all the other samples. Nevertheless, we do expect to see some variations from the different samples. Maybe one sample has more makes more bubbles in the electrolysis than the other. Maybe one sample gets a slightly green colour in the water while another sample gets a yellow colour. And if nothing happens at all in the electrolysis we know that the water from Orrestranden at least will show some colours and effect.

And, of course, we hope to have a fun time experimenting our way towards answers.

II.
The analysis of different aquatic ecosystems

One part of the project was going out and analysing different waters. From each place we took 0,5 litre sample of filtered water. The reason we filtered the water was to concentrate the amount of algae, dirt/mud or other organisms in it. These samples was taken by Ron and used to search for organisms, and then look at them under a microscope. When taking these samples we tried to get as much debris from the water as possible into them to increase the amount of organisms. Then write down all the organisms that were found. After that, the samples were filtered so that all the debris and algae got separated from the water. This algae and debris was then dried in two days and then seen under the microscope. That way one could see what algae the samples had, and one could also spot the smallest organisms which normally would be to difficult to see because of their speed in water. Then the remaining water was electrolysed in about 30 minutes to see if there was a lot of salt in the water.

We also took another 0,5 litre sample, not filtered, which was used by Fredrik to measure the Ohm levels. The higher the Ohm the more resistance, which means there's less salt in the water. We also measured the Ph levels in each place two times.

The last samples were only taken by Møllevannet, which is river that runs through Bryne, our hometown. In the middle of Bryne the rivers runs very calmly and has many ducks swimming in it, we don't know if the ducks have in some way affected this water. But lot's of bread is thrown into the water to feed the ducks, and in some areas there's also fish, but I haven't seen those in 10 years. We didn't expect this river to have any algae at all, but in fact and to our astonishment it had more than most of the other places. Espen took a big sample from this place, and then put these algae into new liquids, to see how the algae reacted, or if they died. They were placed under strong light and were photographed for each day to record any differences.

This is what our experiments were in each of the places; we have taken picture from each spot to add some colours to the reports, and also for you to understand how the environment around the water is. We hope you enjoy reading the reports and learn from it, just as we've done making them.

Picture of a backswimmer, this organism was only found in Frøylandsvannet

II.
I.
Report of Frøylandsvannet

One of the five lakes we made a report of was Frøylandsvannet, which is a large lake not far away from our homes. There are many forests next to the lake, but where there are no woods, there's agriculture. There have been made many attempts to clean this water. When you walk along the path near the lake you can see several water cleansing parks. Even if these parks have made a difference, the water is still not clean. Nevertheless, Frøylandsvannet was once completely clean, meaning, it had no algae. It was common to bathe in this lake. But now that has changed. And in summer you can see many algae blossoming in the water. When we took samples from the water we didn't see any algae. But after filtering it with our landing net, the water quickly turned green. Clearly there were algae in this water. We also realized that Frøylandsvannet has more organic life than all the other places. We discovered at least 3 organisms that weren't found in any of the other areas. There's a lot of nature surrounding this water, including many plants growing in the water, which may contribute to the amount of organisms. The algae level in this water was also clearer than the other places. After filtering the water in the landing net, it had a greenish colour to it. We only experienced this same colour in Møllevannet. We believe that the reason there's high level of algae in this water is because of the nearby agriculture. Lot's of phosphate and nitrate from the agriculture gets into the lake giving the algae minerals to blossom. This actually happened in our project when suddenly high amounts of algae were seen in the lake. We quickly went down to take a sample. We didn't have to filter anything to make the water green, and not only was it green but it also

smelled disgusting. By looking at these algae under the microscope we found a lot of green round algae, and some algae formed like sticks. This was the best sample of algae in the entire project, but because it happened so late, we didn't get to experiment with the sample as much as we did with the other.

Results from experiments:

The Ph level of Frøylandsvannet when we took it was about 6.3. There were a lot of organisms in this water. Three of which weren't found in any other place. We found 2 water leeches moving back and forth in the water. We found one big backswimmer, bigger than a fly. And a half one which obviously was dead and so we could easily study it under the microscope. A mosquito was also spotted floating about. We were also so lucky that while investigating debris in the water we saw a second mosquito inside the debris. As we investigated this under the microscope it was clearly that the mosquito ate something. It was difficult to spot what it exactly ate, and since the mosquito almost is transparent, it was somewhat disgusting to look at it eat. Nevertheless, it was very fun. These three organisms where only found in frøylandsvannet. One reason may be, because we were just very lucky to have caught them, or it might be because they only live in frøylandsvannet. We believe, however, that the backswimmer is only found in frøylandsvannet and not in any of the other reports we made. By looking at the water without a microscope you can see many small dots moving around. It is difficult to see exactly what these organisms are, but after a while you can see the difference by the way they move. We had a lot of mites, which looked like round dots flying slowly through the water. We spotted one the microscope, but it was difficult to see because it never stood still. There were also a lot of copepods in the water, not as many as the mites though. You can spot these because they are bigger and the swim through water by jumping around rather than gliding straight through the water. Two of these we saw under the microscope, one a female because of her eggs which is clearly seen behind her body, and the second a male much smaller than the female. We were also so lucky to spot a daphnia under the microscope. We could barely see it, but once and a while it slowly floated through the image. It was difficult to find it because of its transparency, so we didn't get a good image of it. But by looking at the shape it was clearly a daphnia. Daphnia can only be spotted under a microscope because of their small size.

There are a lot of small organisms in water, and there's more than the ones we described here. I've only taken time describing the organisms that we found, but we know there's more. A more thorough description about these types of organisms is written in the second last chapter of this project.

Ohm levels were measured as 28 000 Ohm

There's not a lot of salt in frøylandsvannet, or any other lakes in general. By using 9V we electrolysed the water to see if something happened. Even if there were some minor bubbles coming from the anode, nothing else more happened. The electrolysis lasted for about 30 minutes.

The result of frøylandsvannet indicates that there are a lot of algae in the area. There's even warning signs about the algae. Frøylandsvannet is in the midst of an agricultural area, which we believe is the reason for all the algae. Frøylandsvannet is a part of several small forests and we believe that's why we found more organisms in this place than any other. There's much

more plants in the water than any other lake in our report. And it's also the biggest water we took a sample from, excluding Orrestrand.

here is our sample from Frøylandsvannet. There was lots of debris in our sample, which may be one of the reasons we got so many different organisms.

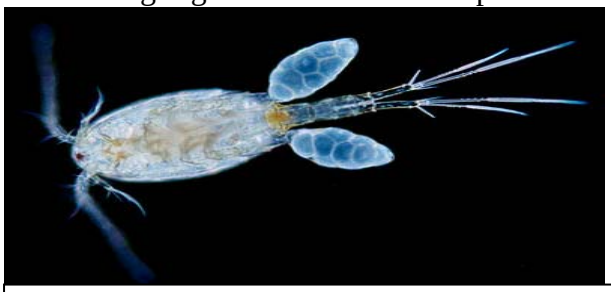
Here you see our sample of the algal bloom that happened during our project

II.
II.
Report of Fotlandsfossen

Fotlandsfossen is a river running trough an area with lots of agriculture. It's not very close to where we live, but we knew about the place and felt that we should sample it. The river was once used in a mill to produce grain, but now it's turned into a museum. The river turns into a fall close to the mill making it a very nice place to visit. Unfortunately the day we came there, and because of all the rain, the river had overflowed. The fall was too big to take a nice picture of, and we got our shoes wet as we tried to take a sample because of all the wet grass around the river. We didn't quite know if there was going to be a lot of algae in this water, and after filtering the water we didn't get a green colour, but it was more brownish. This meant that we didn't just filter algae but also other dirt from the water. There are plants in the river, although I'm not sure if those plants are found everywhere. Before the river turns into a fall it flows past a small forest. After the fall it continues through the agricultural areas.

Results from experiments:

The Ph level we measured came at 5.7.
There's not as much life in fotlandsfossen as in our other samples. We believe it's because it's a river. We didn't use the microscope as much as we did with frøylandsvannet. Watching small fast moving organisms in a microscope is difficult and time consuming. We looked at



A female copepod in the water (The picture above), you can clearly see that's it's a female by the two eggs she carries behind. A copepod is about 1mm big, and can be seen in the water easily. (Second picture) This is our sample from Fotlandsfossen. You can see the debris and algae mixed together.

There were some mites, and other small organisms in the water, but their small size made the difficult to spot in the microscope and thus difficult to identify.

Something we did with Fotlandsfossen, which we didn't do with frøylandsvannet, was to filter the water again so that all the debris and algae were separated from the water. Then we dried it. It took about 1 hour to filter the 0.5 litre water completely, and then it was dried for two days on aluminium-paper. Also organisms were filtered so we could watch them on the microscope easily because they weren't alive (They didn't move). The colour of the dried algae from Fotlandsfossen had a dark green colour to it, which suggest that it wasn't pure algae, but a mixture with some dirt from the water.

The ohm levels of this water were measured as 31 000 Ohm

The electrolysis of this water wasn't that remarkable. The only thing we saw was bubbles coming up from the anode. The electrolysis lasted for about 30 minutes with 9V, with minor results.

It is clear that rivers have fewer organisms than lakes. This argument is supported by the sample from the second river we investigated which also had few organisms. We might ask ourselves why there are so little algae in this water when it runs through such a large area of agriculture. The current of the river was quite strong, which surely must have something to say. There's a river next to Orrestrand that we didn't sample, but it was clear that this river was filled with minerals and plants. Just as fotlandsfossen, this river ran through agricultural lands, however, it had almost no current whatsoever. In fact, we didn't see the river move at all when walking down to it. The river was filled with small plants on top, which indicates that there are minerals for the plants to live. Both fotlandsfossen and this river flow through agricultural places, but there's a big difference in both of them. Also the second river we sampled had a lot more algae than fotlandsfossen, and it too had less current.

This is the river we didn't sample. It's obvious that the land around affects it. Although the green you see floating on the water is small plants, or leaves.

II.
III.
Report of Møllevannet

Møllevannet is the second river we sampled. It's a river running through Bryne. It comes from Frøylandsvannet, and that might explain why we found so much algae in this river. It's now obvious that algae concentration is reduced in a river compared to a lake. High levels of algae have many times poisoned Frøylandsvannet, but that has never affected Møllevannet at the same levels. Still, we do se a resemblance between these two places. Both of them had green water after we filtered it. And in fact Møllevannet had greener water than the one we sampled from Frøylandsvannet. The current of this river is quite slow compared to fotlandsfossen, which might be a reason why there are more algae in this river than fotlandsfoss. There are about 20 ducks swimming and living in this river, and there are also many people who feed these ducks with food (chunks of bread). If these ducks or people in some way affect the river we're not quite sure of, since ducks only swim in water, they don't breathe under it. There's been spotted small amounts of fish in specific areas of this river, but we've not seen any fish in it for a very long time. We took a big algae sample from this river, because of the high algae levels. We separated these algae in different liquids to see how they survived. This experiment is written in chapter 3 "Study of the algae's survivability".

Results from experiments:

The Ph levels we measured in this water were 6. Just as with fotlandsfossen, there were not a lot of organisms in this sample as compared to the others. It was a big difference when we looked at this sample and then looked at a sample of Tjødna. If we stared at the Tjødna sample our eyes would quickly recognize small organisms in the water moving around back and forth. But when we stared at the Møllevannet we found very few moving organisms. We found no copepods, at all. Also there weren't many mites. But one thing that struck us was that after a day with this sample we could see algae floating in the water. This hadn't happened to any of

the other samples, where all the algae and debris had sunk to the bottom. The algae in this water were floating. It became clear that the algae levels in this river were much higher than any of the other samples. View picture on next page.

This is a sample from Møllevannet compared to a sample from Orreelv. You can clearly see that Møllevannet (picture to left) has green algae floating in it, and some green that have sunk to the bottom. Orreelv, on the other hand, doesn't have anything green floating; instead it has a brownish colour, which has sunk to the bottom. Nevertheless, if you study the edge of the black circle you can see something yellowish looking like a cloud in the water, which might be a sign of algae, yet it's not as green as the one from Møllevannet.

The water of Møllevannet was also filtered once again so that we could separate the algae from the water. We dried it for two days as we did with all the other samples. The result distinguished itself a lot from the other dried algae. Many of the dried algae had a dark green colour, but Møllevannet had a light green colour. It meant that there where a better concentration of algae in this water than any other. The light green algae were also much more liquid than the others which mean there was little debris in the water.

Ohm levels of this water were measured as 36 000 Ohm

The electrolysis of this water didn't surprise me. It was just the same as every other sample I had been doing. There is salt in the river, no doubt about that, but it's not a lot. At least it's not enough to give us a cool result with many cool different colours. I experienced some bubbles bubbling up from the anode, but nothing was happening at the cathode. The bubbles by the way, in case you wondered, are oxygen or hydrogen molecules formed by water when electricity passes through. If there's a lot of salt, there are a lot of bubbles, since the electricity passes trough the salt. If there's enough salt, both the anode and the cathode will make bubbles.

Møllevannet is the water with highest concentration of algae accordingly to what we found. We do not know if the ducks in the water affect the organic life. But we don't believe it should. Ducks don't eat planktons or mites, or daphnia, or anything else that is small and swims in the water. Every river we sampled had very low levels or organisms. It's got nothing to do with the ducks. We also have no reason to believe that ducks make algae grow any better. The reason this river had so many algae must be because it came from Frøylands- vannet. Another reason why there are algae in this river is because the current is so calm.

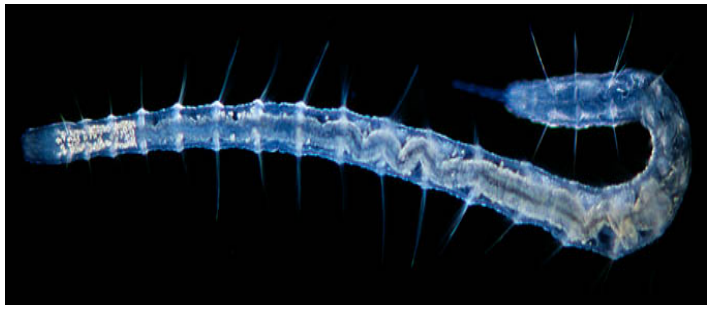
II.
IV.
Report of Tjødna

Tjødna is a lake that is quite close to us. We have always thought the water there dirty. It might be because of all the birds that live there, or it might be because of the nearby grazing grounds. The water was polluted earlier, but there has never been any big problem with algal growth. Some people actually bathe in this water, but all we three keep from that: from time to time you can actually see dead fish flowing in the water, and the bottom is just plain gross. We think that the lake bed is covered with clay or some similar material, perhaps a thick layer of mud. The surface of the water is also covered with bird droppings.

Results from experiments:

The Ph measured from Tjødna was 5.9, which didn't differ a lot from any other samples. Tjødna was very exciting to study. Because it's a lake, it actually has quite a few organisms in it. By looking at the sample in 4

seconds you can already see swarms of small mites, copepods and other organisms swimming. We looked at 2 copepods under the microscope though we spotted at least 3. At first it was difficult to get a proper view of the copepods, but after 5 minutes we had managed to evaporate all the water around it so it couldn't move. Now we could study the copepods with no problem, while they probably were being chocked to death. Another organism that we hadn't seen before was the Oligochaetes, which are a type of worm that has small bristles along their body, and wriggle trough the water. They move fast and are hard to catch so unfortunately we didn't manage to see it under the microscope. But it is easily spotted with the eye. There was only one worm like this in the sample, and it was about 1 centimetre long, if not a bit shorter.



A picture of a mite. The images of mites we got from the microscope were much less clear; we could only see a round circle flying quickly through the water. The second picture, as you might've guessed is from a worm. You can almost see the bristles from his body, which helps him move in water.

We filtered the water separating the algae and debris from the water itself, and then dried it for two days. Since it had a lot of debris the colour became dark green and thick compared to Møllevannet, which was light green. We didn't get time to study what we had dried, under the microscope as we had planned. But one can clearly see the difference between the dried algae in Tjødna and the other samples. Tjødna has a much more thick algae compared to the rest, which is a result because of the amount of debris we collected from Tjødna. The more debris you collect the greater chance you have of finding organisms. But it seems as though there's way too much debris in Tjødna than there's algae. That's easily seen in the picture below where almost the entire bowl is covered with dirt.

The bowl to the upper left on top is from Tjødna and has much more debris and dirt than any other of the samples.

Ohm levels of this water were measured as 30 000 Ohm

We then electrolysed the water to see if it had more salt than the other samples. The electrolysis this time lasted for about 1 hour to see if the results would differ from those that

only had been electrolysed in 30 minutes. But the results were still the same, small amount of bubbles on the anode, and nothing more.

Tjødna has lots of life just like the other lakes we measured. It's now become clear there are fewer amounts of organisms in rivers than lakes. Every lake we investigated also had one organism that a different lake didn't have. Had we spent more time studying the water under the microscope we wouldn't most probably discovered even more organisms. But that requires lots of patience and time. We didn't spend a lot of time studying this sample, and other samples. We could've spent several hours like we did with frøylandsvannet, but that would consume the entire day, which unfortunately we couldn't afford.

II.
V
Report of Breiavannet

Breiavannet is another lake found in the midst of Stavanger. You can't miss it, because of its location. We took this sample one day before school begun. There's a path around this water that many people use. And trust me, measuring the Ph in this water, and using a landing net to sample water wasn't the coolest thing to do with so many people around us. However there were some plants close to the path and we took most of our samples close to these plants to maximize the debris we could get. Breiavannet is a lake with ducks just like Møllevannet. We can now prove that ducks have nothing to do with growing lots of algae, because Breiavannet had very little algae in it, while Møllevannet had most of all our results. There's also supposed to live fish in this water, just like there's fish in Møllevannet. Just like Møllevannet, there's not a lot of nature around Breiavannet. It's in the middle of a city and just about 6 metres close to the road. But the difference between Møllevannet and Breiavannet is, that Mølle is a river while Breia is not. We got many organisms in our sample from Breiavannet, and even got to see something that we had never seen or heard of before. This is why taking samples from lakes are so much more fun then rivers, the results are so different.

Results from experiments:

Ph levels measured in Breiavannet were 6. One can clearly see that the ph in any of our samples varies from 5.7-6.3, the difference isn't a lot. There were many organisms in Breiavannet just as the other lakes we took samples of. We found copepods and mites, which were the usual. But in addition to that, we also found one Oligochaete, (the worm which we

found Tjødna) but didn't manage to capture it and to look it in the microscope. Trust me, it's not as easy as it sounds, or looks like, especially when you don't want to kill the worm. We took picked up a piece of debris from the water just for fun to see how it looked like, when we suddenly discovered something very interesting in the microscope. The debris was small round black dots on the microscope, but we could see something small moving behind these dots. It was transparent and very small, but it moved around the debris like he was eating something from it. It was very difficult to see exactly what organism this was because of its small size but accordingly to the book I used it looked like a microscopic crustacean or a "muslingkreps". Its body was elastic and it didn't exactly swim, but moved by around the debris like a snail. It was interesting to watch this organism walk around the debris probably feeding from it. It's times like these you wish that you had a better microscope, which could view not only the organism but also the organs inside it.

We separated the algae and debris by filtering the water, as seen in the picture below.

(Left picture) Water sample from Tjødna being filtered, so all the algae and debris were separated from the water. (Right picture) The sample from Breiavannet. It resembles a lot the sample from Orreelv. Orreelv, however, looks thicker and darker.

The filtered algae and debris became very hard after we had dried it for two days. Thus looking at it through a microscope didn't give us any special pictures. It had become so hard that it the microscope could not watch through it, and thus it was difficult to view any organisms that had been stuck in the filter. This was unfortunate for us, because it could've given us cool pictures of algae and other organisms.

Ohm levels of this water were measured as 30 000 Ohm

There's not a lot to say about the electrolysis other than the usual. A few bubbles streaming up from the anode, which proved that there's little salt in the water. The electrolysis lasted for about 30 minutes in 9 Volt.

In this sample we found out that there's very much life inside a water sample, more than we thought. There are thousands of organisms our eyes cannot spot, and even more that our microscope didn't spot. We were lucky when we found the microscopic crustacean in the debris. This organism was very small, and also very unclear for our microscope. We would've most likely found many more organisms not just in Breivannet but in our other samples had we spend more time with them. There are not a lot of algae in Breiavannet accordingly to our

results. By looking at the picture above, you can hardly notice any clouds floating in the water. The water looks perfectly clear except for the debris on the bottom of the bowl.

II.
VI.
Report of Orreelva

Orreelva, as we call it, is the last river we took a sample from. It's located near the coast and runs out the Orrestrand. The river comes from Orrevannet eventually leading all the way up to Ålgård. As you can see in the picture the river is located very close to the farmlands just as most rivers in Norway are. We didn't notice a lot of algae in the river but it had a lot of debris in it. The water itself had a brownish colour to it. There's another different river close to this, which looks extremely different. There's a picture of it in the report of Fotlandsfossen. It's much smaller and has almost no current, but it's much greener that Orreelva. It's a very interesting difference. We believe that the size of the small river must be a reason to why it's so different, it looks as if its' squeezed between the two agricultural lands, as if it's got too much minerals compared to the size of it. Orreelva is not close to any road as you might think when viewing this picture. This is in fact the only road going over the river as a bridge. There's not much nature around the river except the agriculture and some few houses. And while reading this report, note that we don't know the exact name of this river, and therefore call it "Orreelva".

Results from experiment:

Ph levels measured around Orreelva where about 6. There wasn't a lot of organic life in this water just as in any of the other rivers. We spotted 2 copepods swimming around. Copepods are very usual organisms in the water. Which we didn't have to find out trough reading, but we found it out by our experiments, which again is a part of what our project is about. Every report had copepods except Møllevannet. We managed to gather a lot of debris from Orreelva compared to any of the other reports. Even though, there weren't many organisms floating around. There's also a yellow cloud around the debris, which might indicate algae. It's not as

intense as Møllevannet, but there's something floating on top, which can be viewed in this picture.

(Left picture) The sample from orrevannet. You can see the debris at the bottom, however, there's a yellow cloud around it, which might be an indication of algae. (Right picture) This is where we stood when taking sample from Orrevannet; we took samples close to the big grass in the water.

Since we don't the newest modern equipment it's difficult for us to know if the yellow cloud in the orreelva is in fact algae of not. But after filtering the algae and debris from the water we got a much clearer result. What we had filtered was dried in two days, and by the colour of it, we can't say there's a high amount of algae in this river compared to others. The more algae there is the greener the colour becomes, the colour we got out of Oreelva was dark green, which was quite similar to any of the other samples we had. Therefore the yellow cloud we see in the water doesn't necessarily have to be lots of algae. Had it been algae we believe we had gotten a different colour than dark green.

Compared to all the other electrolysis we had done. This one, in fact, had a difference. The electrolysis was with 9 Volt and lasted at least 30 minutes. We used more time electrolysing this sample because of some *irregular activity*. Out from the cathode there was a clear blue colour rushing out. It wasn't a lot but it was something. There were small amounts of bubbles coming up from both the cathode and anode. I've experienced such a blue colour in previous electrolysis. Blue colour occurs either from sulphur, chloride or when the copper cathode (Which we used) becomes oxidised. Accordingly to the blue colour we believe it's the copper getting oxidised. Sulphur and chloride has a much lighter blue colour than the one we experienced. At last something's happening to the electrolysis. Although this is nothing compared to what happened in Orrestrand.

This sample of Orreelva didn't contain lots of algae or organic life; at least we didn't find that under our investigations. Orreelva as any of the other rivers didn't have a lot of organic life. But the electrolysis of this water was interesting. Had we electrolysed the water longer we might've gotten more colours out of it. But we lacked time. We had to use the rest of the time electrolysing Orrestrand since we knew it would give more radical results than any other sample. The yellow cloud found in the sample might simply be debris. If it had been algae the colour would most likely be green instead of yellow. Yet, it is interesting to see how the samples differ from each other. Why did Orreelva have such a yellow cloud while others didn't?

II.
VII.
Report of Orrestrand

Orrestrand is basically a part of the ocean west of Norway. As we all know ocean contains high amounts of salt. We didn't expect the ocean to have lots of algae or organisms so we didn't bother to investigate that. Instead we took a sample that we could use to electrolyse. The ocean was very clean and there were lots of waves. So we had to dig a hole in the sand and let water flow into it. Then we took the sample from the hole that we had made.

Results from experiment:

The salt level in the water is way too high for any organisms to live in it. So we didn't analyse that. We didn't see any organisms with out eye either. The water was totally clean; there were no debris and no algae. There was some sand at the bottom from the beach.

Ohm levels of this water were measured as 13 000 Ohm

The electrolysis of this water was the most exciting electrolysis in our whole project.


The first picture shows the sample of the ocean. You can see how clean it is with no colour at all. The second picture is about 1 hour into the electrolysis. The electrolysis lasted for about 3 hours.

By looking at all the different colours it's clear that there's not only one salt in the ocean, but many different types. There's white, red, black, brown, yellow, and also some light blue coming out from the cathode, which means that there's many different salts. Had there only been one colour there would've most likely only been one salt. The electrolysis lasted for about 3 hours using 9 V batteries. It bubbled a lot from the cathode and a bit less from the anode. The electrolysis dissolved the anode in this sample. The metal became so soft it was like paper And since the anode got dissolved I didn't get so see if it had changed its colour, the cathode, however, had gotten a brown colour to it. We stored this sample for about 1 week. Now the water has turned brown with something brownish floating in the middle.

III.
I.
The Algae

The green algae are the most common species of algae in freshwater lakes. Although common, the algae have a wide array of shapes and sizes, and can range from the tiniest, one celled organism to meter high seaweed.

Green algae is not really an own specie, but it is a term used for may, often unrelated groups of organisms able to perform photosynthesis, some of them are the desmids, one celled organisms that has spectacular symmetrical shapes, the volvox, a colonial organism that creates complicated societies in a sphere shaped colony and the diatoms, cylindrical creatures that have a brownish colour to them.

There are a few things that are in common for all algae. One of these things is the ability of photosynthesis. It is calculated that algae stand for over 80% of the earth's photosynthesis, which is quite a large amount. Algae also usually live in colonies, the size of these colonies may vary greatly in numbers and in volume.

Not all algae live are aquatic, some species are terrestrial, and can live as a thin layer on rocks, in snow, in soil or even in symbiosis with other organisms, like fungi and animals.

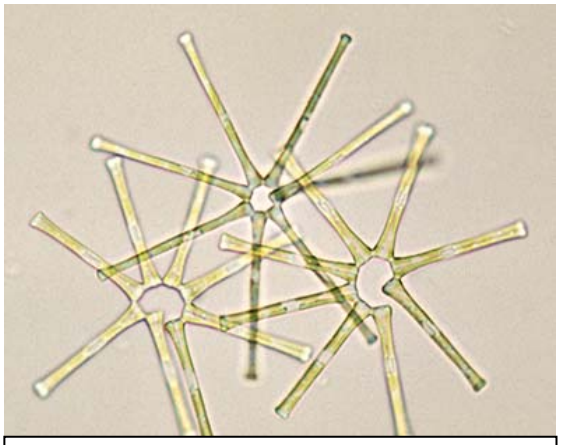
There are many species of algae; some of the most common groups are:

- Green algae (Chlorophyceae)
- Diatoms (Bacillariophyceae)
- Euglenoids (Euglenineae)
- Blue-green algae (Cyanophyceae)

Here is a short description of some of the different species.

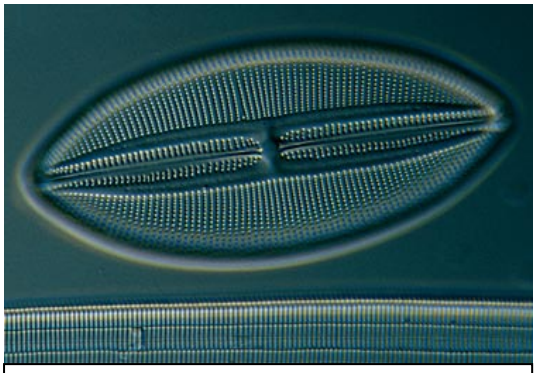
The Diatoms

The glasshouse plants



Asterionella, a colony of pennate diatoms photographed by Jan Parmentier.

I am going to give quite a brief explanation of the different species of algae. The first is the diatoms. These plants are quite different from other algae; the most noticeable thing is that it is brown instead of green. The reason for this is it's brownish chloroplast. Another thing that is special about the diatoms is its shell, which is made from silica, the same material used in glass manufacturing.



Here you can see the slit that runs along the body of the pinnate. This is where the microfibrils are situated.

There are two types of diatoms, there are the pennates, which are pen shaped, Asterionella is a pinnate. There is also the centric, these algae have the shape of a cylinder, the centric are somewhat more rare than the pennates

The diatom pinnate evolved later in earth's history than the centric. Therefore they are supplied with a form of locomotion. Little is known about how this works, but it is suspected that tiny microfibrils, situated in a slit on the side of the algae, has something to do with the ability of movement.

The Desmids

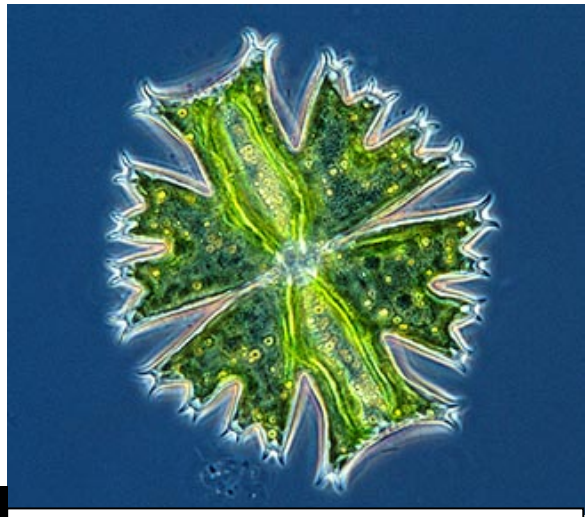
A subspecies of green algae

Desmids are a species of fresh-water algae, recognized by their spectacular shapes. The desmids are known by their symmetry. Two ornamental semi-cells are joined in the centre by a small connection called the ithmus.

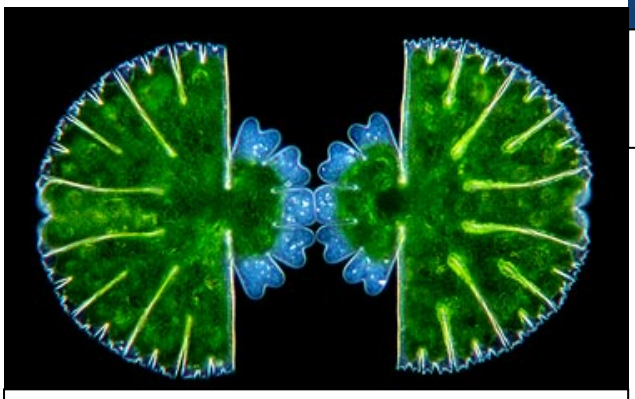
Desmids may vary widely in shape. They might be formed like a star, a knob or even be moon shaped.

The desmids reproduce by cellular splitting

Here you see how the whole process works, the desmids splits in ithmus, and start to grow a new semi-cell, it is often normal to see a desmids with one semi-cell less developed than the other.



Micrasterias crux melitensis, in the center you see the ithmus, connecting the two semi-cells together.



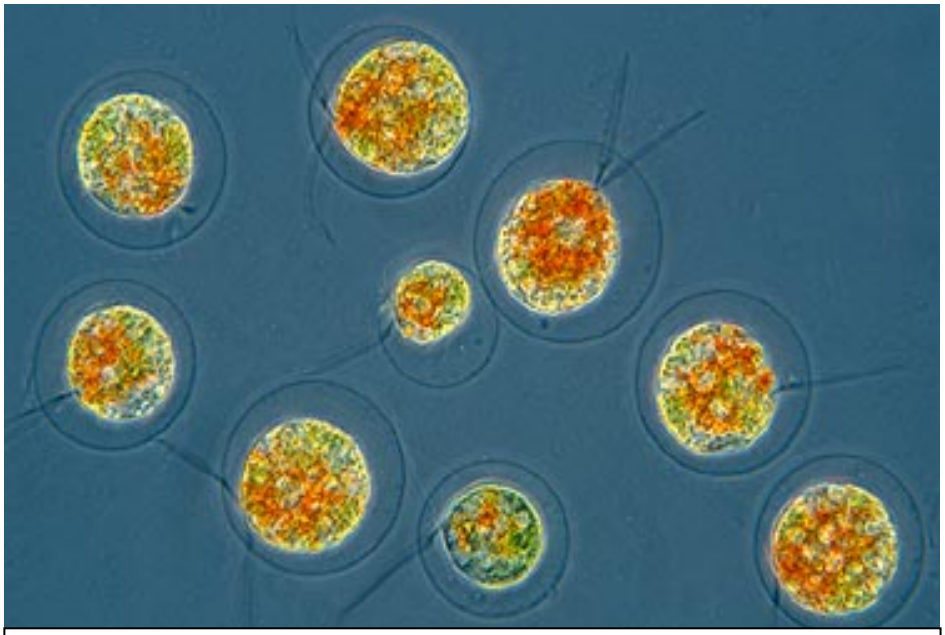
Here you see how the desmids look like, a short time after they've reproduced.

The Green Algae

The ocean plants

The green algae in one of the most common type of freshwater algae, and is also the type that has greatest variety of shapes and sizes.

Some of the green algae that are single celled and colonial have small tails “flagella” that they use to move their colony around. To do this they need to cooperate extremely well.

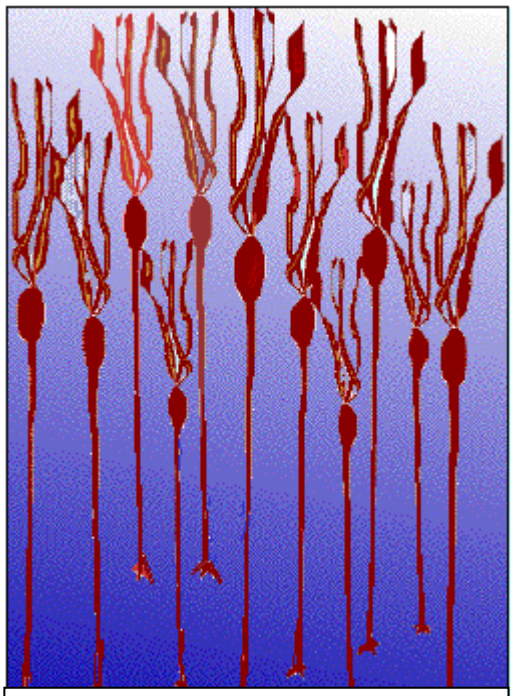


If you have a birdbath with water that has turned red you may find the green algae *Haematococcus pluvialis*.

Here is an example of green algae with flagella.

Note that although they belong to the green algae, they don’t look like green algae. The chloroplast may turn red if the conditions are unfavourable.

Not all green algae are simple, one celled organisms however. The huge seaweeds also belong to the green algae. And these are far from simple. The kelps and weeds of the seabed are just as complex as our normal surface plants. Although they are somewhat more flabby than their surface cousins.



Here is a drawing of some seaweed. You can see the elongations over the bulb, these acts as leaves.

III.
II.
Problems of an algal blooming

There are many problems with an explosive blossoming of algae in an area. We were so lucky, or rather, unlucky to experience an event like this first hand.

The first thing we noticed was the strong green colour of the water, when we took a sample of the water. The whole sample looked like it had been filtrated way too many times.

The Fryølandsvatn has a big problem with its annual algal bloom. If you take a trip around the lake, you can see many warning signs that are placed at many strategic positions that warns against bathing in the water.

Here we are at Frøylandsvatnet, taking samples of the incredibly nasty algal bloom.

Here you can see one of the many warning signs that are placed around Frøylandsvatnet.

We have gathered as much information about this algal paradise as we can, and you can find this material in the appendix.

At a general rate, algal blooms can be a real trouble, an algal bloom comes into being when the conditions for algal growth are especially ideal, the main source of this much nourishment is when dung, used as a fertilizer in farming, is washed out into a lake.
This makes an abundance of phosphorus and nitrogen, the two primary nutrients that algae need to reproduce.

What we saw in the Frøylandsvatn bloom was that an algal bloom can be quite unpleasant. The goo floating on the surface had a horrible odour; it was almost unbearable. Before the sampling, we got many warnings from worried parents that we must not touch the water, and that it was very poisonous.

An algae blossom can cause many problems; one of the main problems is of course that it is toxic. I have never witnessed an algal poisoning, but I'm sure it can be quite uncomfortable. It is irritant, which means that if in contact with skin, it can cause rashes and terrible itches. It may also cause serious allergic reactions. Some other problems are:

- Clogging of pumps and machinery, this can be quite a pain for water treatment plants.
- Deoxygenation may cause massive fish death, the algae can reproduce at an alarming rate when the conditions are suitable, so they need a lot of oxygen to do this.
- Massive variation in PH value. This can also be very troublesome for the fish, which might die if the PH value gets too low.
- Increased cost of making drinking water. When there's too much debris, algae and bacteria in the water, you need to add many more chemicals to the water to make it drinkable.

This is how the Frøylandsvatnet looked when we last visited it

III.
III.
The study of the algae's survivability

We mixed algae's found in Møllevannet with various types of liquids to see the effect and measure their survival abilities to conclude where and in what environments algae's can live. We also tried to breed algae's in a mixture of water and plant nourishment. After having a look under the microscope we found out the following.

Breeding of algae

Day 5: Because of the lack of movement under the microscope, and the fact that the algae has not visibly grown in days, I have to assume them dead. The reason may be the lack of carbon dioxide, so I will try to add some to the other mixtures by blowing air through a straw in the liquid.

The algae breeding project

Here you can see the breeding bowl from another angle.

Algae with different liquids

The First thing I noticed when checking on the algae was that all the dirt fell to the bottom of the glass, while all the algae floated to the top in all cases except when mixed with acetic acid.

Mixed with bottle water

2005-10-04—19:32 - The algae in the fresh water seems to be doing fine. Under the microscope they seemed to be moving and the following days I will watch out for a visible increase in their population.

2005-10-05—17:44 - The algae are still alive and no noticeable change can be seen visually or under the microscope. Except that the algae's have concentrated into a green line around the edge of the glass.

2005-10-06—17:44 – The algae are now unfortunately dead. I don't know if it was because of the lack of oxygen or any other specific reason.

Mixed with acetic acid

2005-10-04—19:34 - This was the only mixture that the algae didn't float on top of the water on. It rather just floated 1cm below the water surface. When I took an example to look at I found out that the algae was dead. The acetic acid was most likely too sour for them to be able to live in it. When I tested the ph value I found out that a 7% acetic acid mix has a ph of 2.

2005-10-05—17:46 Now the dead algae are turning brown in colour. They seem to be rotting. I think it's no longer relevant to follow its progress. The mixture has also begun to smell quite badly.

2005-10-06—17:47 – There is still no sign of life and I'll just have to give up on this one.

Mixed with Sprite soda

2005-10-04—19:39 - The algae mixed with sprite seemed to be doing all right too. When I looked at them under the microscope they seemed to be moving. This mix will also be looked further into later to see if they reproduce. The ph of sprite is 3.

2005-10-05—17:51 - The algae here have also turned brownish. Only small, dead brown lumps can be spotted in the liquid and the greenish colour have become very faint. The reason is most likely the low ph value of sprite. This mixture also seems to be irrelevant to follow up later.

2005-10-06—17:50 – Just as with the acetic acid mix I'll have to give up on this one too. No sign of life whatsoever.

Mixed with ammonium chloride

2005-10-04—19:43 - This mixture actually seems to be prospering. The water has become visibly greener and the algae seems to be reproducing. This one I'll have to follow up more closely later.

2005-10-05—17:54 – It's really hard to tell if the liquid has become greener in colour, but the algae's are still alive and well. This one will definitively be checked on later to see if further progress is made.

2005-10-06—17:53 – Sadly, these algae have died too. And they have already begun to turn brown. My best guess would be lack of carbon dioxide.

Mixed with sparkling water

2005-10-04—19:47 - The algae seem to be alive, although no visible growth can be spotted. I will look into its progress the following days.

2005-10-05—17: 57 – The same thing has happened her as with the Sprite and acetic acid. The algae has become brown and is no longer alive. I'm starting to wonder if it might be lack of carbon dioxide and that with the straw I couldn't add enough of it.

2005-10-06—17:59 Just as the other ones, these algae couldn't take it either. The green colour has also started to diminish.

Survivability test conclusion

The algae seemed to live longest in normal water and in the ammonium chloride mix. Meanwhile in the acetic acid it died already the first day, and in sprite the second day. With this we can conclude that algae can't tolerate very low ph values. I'm no exactly sure how much longer the algae could have survived in the ammonium chloride due to the lack of carbon dioxide, but they at least seemed to be able to live in alkaline liquids up to a ph value of at least 8.

In acetic acid I found the algae dead already the first day. So we can conclude that algae can't handle very acid condition very well. In sprite, which is slightly less acid, it survived to day number two.

In the sparkling water mix it also died the second day. The reason of this must be either that sparkling water has a too low ph value, also 5 ph, or it must be lack of carbon dioxide.

The results might not be exactly accurate due to not being able to add carbon dioxide to the mixtures and because of we had a low quality microscope.
But mainly I think we got a general idea of the algae's survival ability in different conditions.

End of log.

IV.
Our conclusion

Altogether this was a very exciting project, and we discovered many things we didn't know before. We even got to lots of experiments with dangerous material and make things disappear, what more can a person wish for?

For the first, we discovered that algae are quite sophisticated organisms, and not just the simple colouring of water that we thought it before we started this project.

The algae are very important for the earth's ecosystems, and they're responsible for a very big part of the earth's photosynthesis. Without the algae to act as food and do the photosynthesising, we'd be in quite a mess.

Although the algae have many positive effects, and a big role in nature's play, too many of them are not very good. Algal blooms can be a very big problem, when the circumstances are extremely ideal, the algae starts an explosive growth, resulting in an algal bloom.

An algal bloom occurs when the water has high levels of phosphorous and nitrogen, and may wreck major havoc on the ecosystem in which it occurs. Some of the greatest sufferers are the fish. Whole populations of these critters can disappear during an algal bloom.

The algae are not especially hardy organisms, but they can survive a three days in hostile environments.

Even though we did many experiments concerning algae, we unfortunately didn't have very much time to focus about the other creatures that live near aquatic environments.

As a final word we must say that this has been a quite exciting project to work with, and we think that our method of work, to use experiments and make our own conclusions rather than to just read from different sources and type that down, we have of course done some of that, but we've tried to keep it to a minimum.

V.
I.
Article from Jærbladet: Giftig algebelegg i Frøylandsvatnet

– EKKELT: – Æsj, så ekkelt, synes Ragnhild Ausdal (t.v) og Hanna Elisabeth Laland Hystad. Jentene oppdaga tysdag ei algeoppblomstring i Frøylandsvatnet. (Foto: Jorunn E. Steinsland)

Algar lager igjen ei grøn hinne på Frøylandsvatnet, og fagfolk åtvarar mot giftig vatn.

Av Jorunn Erga Steinsland (Publisert 05.10.2005)

– Folk må ikkje vera uti vatnet når det er slik som nå, åtvarar Svein Oftedal, rådgjevar i Klepp kommune. – Algevatnet kan framkalla allergiske reaksjonar og kan innehalda sterke giftstoff som kan vera farlege å svelgja.
Oftedal hadde håpa å sleppa ei algeoppblomstring i Frøylandsvatnet i haust. Slik vart det ikkje.

Belegg i vasskorpa

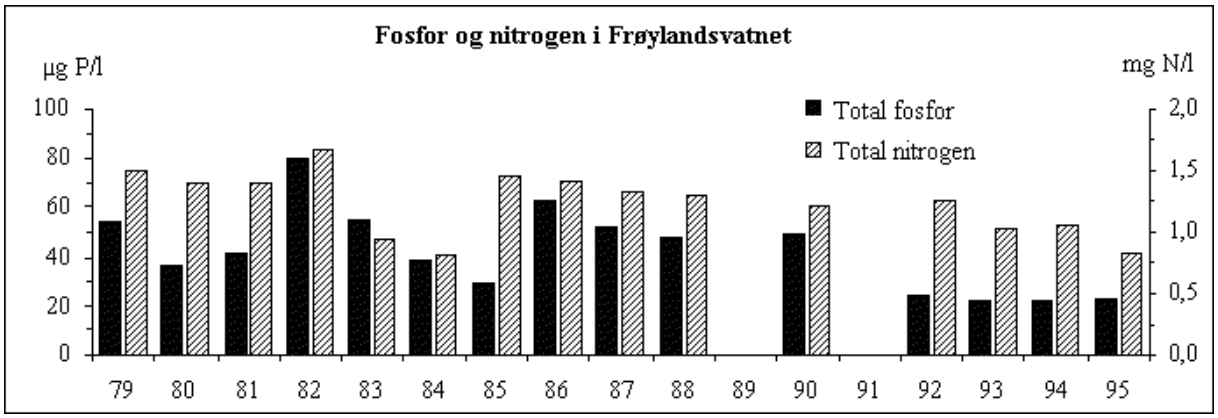
Oftedal synes likevel at det er positivt at oppblomstringa ikkje vart synleg før i oktober, og forklarer at når ei oppblomstring av blågrønalgar blir synleg, er oppblomstringa på hell.
– Når algane er på retur, døyr dei og flyt opp. Slik blir algane liggjande som eit belegg i vasskorpa, seier han, og legg til at det er lite som kan gjerast og at ein bare må venta på at dette belegget skal forsvinna av seg sjølv.
Sjølv om det er negativt at det igjen har vore ei algeoppblomstring i Frøylandsvatnet, har Oftedal likevel oppløftande informasjon.
– Oppblomstringane varer kortare tid enn før. Det viser at dei tiltaka me har sett i gang verkar, men det går seint, seier han.
Algeoppblomstringa treng ikkje vera like tydeleg over alt.
– Dette kan vera ein konsentrasjon som har drive med vinden og samla seg her, opplyser Oftedal.

Oppdaga på skuleveg

Algeoppblomstringa vart oppdaga på Klepp stasjon, av to jenter på veg heim frå skulen. Ragnhild Ausdal og Hanna Elisabeth Laland Hystad reagerte på både fargen og lukta av vatnet. Dei har høyrt mykje om alger i vatnet, men har aldri sett det slik før.
– Me såg at det grønne laget var tjukt, for då endene bevega seg, vart det mørke striper etter dei, fortel Ragnhild.
Jentene kjende óg ei stram lukt og ringde Jærbladet for å varsla om det dei hadde sett.
Dei to fortel at dei ikkje plar å bada i Frøylandsvatnet, men at dei har vassa ein del.
– Det skal me iallfall ikkje gjera nå lenger, slår dei to 12-åringane fast.

V.

II.
Graph for Phosphorus and Nitrogen in Frøylandsvatnet



This graph was found at Time Kommune's internet pages

IV.

Sources

http://www.algae.info/
http://www.microscopy-uk.org.uk/mag/wimsmall/small1.htm
Encycopedae Britanica
Local Knowlegde
Our Heads